

CLAIMS

1. Lock cylinder consisting of a cylinder housing (10.1; 10.2) and a cylinder core (20.1; 20.2), which is supported (11.1) rotatably in the housing,

-- where a key with a defined longitudinal profile is assigned to the core;

-- with a group of diametric shafts (23.1; 23.2) arranged in a row in the axial direction of the cylinder core (20.1; 20.2);

-- which shafts hold plate-shaped tumblers (31.1-34.1; 31.2, 33.2), the longitudinal edges (30.1; 30.2) of which are free to slide longitudinally along guide surfaces (21.1; 21.2) on the sides of the shaft (23.1; 23.2), the tumblers also being spring-loaded (13.1; 13.2) in one of the two directions of their movement;

-- where each tumbler (31.1-34.1; 31.2, 33.2) has a control edge (41.1-44.1; 41.2, 43.2) in correspondence with the longitudinal profile of the key, each control edge being located at a defined height (45-48);

-- and with stops on the tumblers (31.1-34.1; 31.2; 33.2), which come in contact with opposing stops for the purpose of concealing the position of the control edges (41.1-44.1; 32.2,

33.2) when the tumblers are in their rest positions, i.e., after the key has been withdrawn,

characterized in that

-- a lobe (36.1; 36.2) with at least one pair (flank pair) of flanks (37.1, 38.1; 37.2, 38.2) which face in opposite directions with respect to the longitudinal movement of the tumbler projects from the longitudinal plate edge (30.1) of the tumbler (31.1-34.1) or from the guide surface (21.2) of the shaft (23.2) facing that longitudinal edge; in that

-- the cylinder core (20.1; 20.2) has a cutout (26.1) in the shaft (23.1) next to the tumbler (31.1-34.1) or the tumbler (31.2, 33.2) has a cutout (26.2) on the longitudinal plate edge (30.2) facing the lobe (36.2), which cutout has at least one pair of opposing flanks (27.1, 28.1 or 27.2, 28.2) (opposing flank pair), the lobe (36.1 or 36.2) being able to engage in the cutout (26.1 or 26.2) during the assembly operation; in that

-- one of the flanks (37.1 or 37.2) of the flank pair of the lobe (36.1 or 36.2) serves as a stop, whereas the opposing flank (27.1 or 27.2) of the cutout (26.1 or 26.2) serves as an opposing stop for concealing the position of the control edge (41.1-44.1 or 41.2, 43.2) of the tumbler (31.1-34.1 or 31.2, 33.2); and in that

-- the flank (37.1 or 37.2) of the flank pair of the lobe (36.1 or 36.2) facing in the direction of the spring-loading (13.1 or 13.2) and the oppositely-facing opposing flank (27.1 or 27.2) of the opposing flank pair of the cutout (26.1 or 26.2) simultaneously provide a loss-prevention function,

-- which ensures that the structural unit assembled from the spring-loaded (13.1 or 13.2) tumblers (31.1-34.1; 31.2, 33.2) and the cylinder core (20.1 or 20.2) stays together even when outside the cylinder housing (10.1; 10.2).

2. Lock cylinder according to Claim 1, characterized in that the lobe (36.1) is seated on a web (53) of the tumbler (33.1), which web extends in the direction of longitudinal movement; and in that

-- this web (53) has a cutout (54, 55) in the area of the base of the lobe (36.1) to allow the tumbler (31.1-34.1) to be mounted in the cylinder core (20.1) by means of a slanted insertion technique.

3. Lock cylinder according to Claim 2, characterized in that the web (53) has two cutouts (53, 54), between which the lobe (36.1) is seated.

4. Lock cylinder according to one of Claims 1-3, characterized in that the web (53) has a profile which allows

the tumbler (31.1-31.4) to undergo elastic deformation as it is being inserted into the cylinder core (20.2) during the assembly operation.

5. Lock cylinder according to one of Claims 1-4, characterized in that a spring-supporting projection (35.1) is seated on the longitudinal side (30.2) of the tumbler (31.1-34.1) opposite the lobe (36.1),

-- which projection engages in a lateral expansion (24.1) of the shaft (23.1) of the cylinder core (20.1) during the assembly operation and serves as a contact point for the compression spring (15.1) located in the expansion (24.1); in that

-- the expansion (24.1) is located in the shaft (23.1) of the cylinder core (20.1) on the guide surface (22.1) opposite the cutout (26.1); and in that

-- the spring-supporting projection (35.1) has an external outline which facilitates the installation of the tumbler (31.1-34.1) into the cylinder core (20.1) by a slanted insertion technique.

6. Lock cylinder according to one of Claims 1-5, characterized in that, although at least one of the two opposing flanks (27.1, 28.1) of the cutouts (26.1) in the cylinder core

(20.1) is aligned with the corresponding flank of all the other cutouts,

-- the associated flanks (37.1) of the lobes (36.1) of at least some of the tumblers (32.1, 34.1) with control edges (42.1, 44.1) in different positions are offset (52) from each other in the height direction.

7. Lock cylinder according to one of Claims 1-6, characterized in that the lobes (36.1) of all tumblers (31.1-34.1) are of the same design,

-- even though, in some cases, i.e., in cases where the control edges (41.1, 44.1) of the tumblers (31.1, 34.1) are in different positions, the flanks (37.1, 38.1) of the lobes (36.1) are offset (52) from each other in the height direction.

8. Lock cylinder according to one of Claims 1-7, characterized in that the cylinder core has a radial opening for a filler piece next to the shaft; in that

-- the filler piece is open toward the shaft and forms the cutout of the cylinder core;

-- where this cutout carries the pair of opposing flanks with the two oppositely-facing flanks.

9. Lock cylinder according to Claim 1, characterized in that the cylinder core (20.2) has a radial opening (61.2) for an

insert (62.2) next to the shaft (23.2); in that,

-- although the outer end (63.2) of the insert (62.2) does not project beyond the external contour (65) of the cylinder core after the insert has been installed,

-- the inner end (64.2) forms the lobe (36.1), which projects into the shaft (23.2).

10. Lock cylinder according to Claim 9, characterized in that, during the assembly of the structural unit, the tumblers (31.2, 33.2) are first installed in their shafts (23.2), and then the springs (13.2) are mounted in their shaft expansions (24.2); and in that

-- only then are the inserts (62.2) placed in the openings (61.2) in the cylinder core (20.2), as a result of which the projections (36.2) which they form produce the loss-prevention effect.

11. Lock cylinder according to Claim 9 or Claim 10, characterized in that at least parts of the openings (61.2) at the individual shafts (23.2) and/or parts of the inserts (62.2) are connected axially to each other.

12. Lock cylinder according to Claim 11, characterized in that the individual inserts (62.3, 62.3'; 62.4, 62.4') are permanently connected to each other at their outer ends (63.3;

63.4) to form the teeth of a comb-like body (comb 68); and in that,

-- when the inserts (62.3, 62.3'; 62.4, 62.4') are to be installed, the comb (68) can be handled as a unit and inserted into the uniformly designed openings (61.3; 61.4) in the cylinder core (20.3; 20.4).

13. Lock cylinder according to one of Claims 9-12, characterized in that a set of different combs (68) is assigned to a plurality of similar cylinder cores (20.4),

-- whose teeth is assigned by inserts (62.4, 62.4') with different lobe profiles; and/or

-- the teeth of the combs being designed with similar lobe profiles (36.4, 36.4'), where some of the profiles are reversed and/or where the normal and reversed profiles are arranged in different sequences on the comb (68);

-- where, in order to increase the number of variations of the lock cylinder, one of these different combs (68) is selected and inserted into one of the cylinder cores (20.4) of a uniform type.

14. Lock cylinder according to one of Claims 9-13, characterized in that the expansion (24.2) in the cylinder core (20.2; 20.4) which holds the compression spring (15.2) proceeds

from the guide surface (22.2) opposite the insert (62.2; 62.4).

15. Lock cylinder according to one of Claims 10-14, characterized in that, although at least one of the flanks (37.2, 38.2) of the lobes (36.2) in the cylinder core (20.2) is aligned with the corresponding flanks of all the other lobes, -- the associated other flanks (27.2, 28.2) of all the cutouts (26.2) are offset from each other in the height direction at least in the case of some of the tumblers (31.2, 33.2) with control edges (41.2, 43.2) in different positions.

16. Lock cylinder according to one of Claims 10-15, characterized in that the lobes (36.2; 36.3, 36.3'; 36.4, 36.4') of all the inserts (62.2; 62.3, 62.3'; 62.4, 62.4') are of the same design,

-- even though the opposing flanks (27.2, 28.2; 27.3a-28.3i; 27.4a-28.4i) of the cutouts (26.2; 26.3; 26.4) are offset from each other in the height direction in certain cases, i.e., in the case of the tumblers (31.2, 33.2; 31.3-34.3; 31.4-34.4) with control edges (41.2, 43.2; 41.3-44.3; 41.4-44.4) in different positions.

17. Lock cylinder according to one of Claims 1-16, characterized in that, after the structural unit has been installed in the cylinder housing (10.1; 10.2) and while the

tumblers (31.1-34.1; 31.2; 33.2) are in their resting state, the contact of one of the lobe flanks (37.1; 37.2) with the opposing flank (27.1; 27.2) determines simultaneously the maximum depth to which the tumbler (31.1-34.1; 31.2, 33.2) can enter the locking channel (12.1; 12.2) of the cylinder housing (10.1; 10.2).

18. Lock cylinder according to one of Claims 1-17, characterized in that the cooperating stops and counterstops of the lobes (36.1; 36.2) and the cutouts (26.1; 26.2) are arranged in such a way that:

-- in the resting state, i.e., after the key has been withdrawn, the control edges (41.1-44.1; 41.2, 43.2) of at least two tumblers (31.1-34.1; 31.2; 33.2) are located at the same height (50.1, 50.2; 50.3) with respect to the cylinder axis so that their positions are concealed.

19. Lock cylinder according to one of Claims 1-18, characterized in that the cooperating stops and counterstops of the lobes (36.2) and the cutouts (26.2) are arranged in such a way that:

-- when the tumblers (31.2, 33.2) have been pushed down as far as possible against the spring-loading (13.2), at least two are at the same height (60.1, 60.2) with respect to the cylinder

axis.

20. Lock cylinder according to one of Claims 9-19, characterized in that the insert (62.3, 62.3'; 62.4, 62.4') has, at its inner end (64.3; 64.4), a lobe (36.3, 36.3'; 36.4, 36.4'), which is convexly profiled in the radial direction with at least two pairs of flanks (37.3i, 38.3i; 37.3a, 38.3a; 37.4, 38.4; 37.4', 38.4'), which are arranged in sequence in the direction of longitudinal movement and are at different heights; in that

-- the cutouts (26.3; 26.4) in the tumblers (31.3-34.3; 31.4-34.4) are concavely profiled in the radial direction and have sections which form at least two pairs of opposing flanks (27.3i, 28.3i; 27.3a, 28.3a; 27.4i, 28.4i; 27.4a, 28.4a), which are arranged in sequence in the direction of longitudinal movement and are offset from each other in the height direction; in that

-- one of the flanks of a certain pair (37.3i, 38.3i; 37.3a, 38.3a; 37.4, 38.4; 37.4', 38.4') of the lobe (36.3) cooperates with the opposing flank of its assigned pair of opposing flanks (27.3i, 28.3i; 27.3a, 28.3a; 27.4i, 28.4i; 28.4a, 28.4a) of the cutout (26.3; 26.4) to define a stop-counterstop pair; and in that

-- the stop-counterstop pair of at least two tumblers (31.3-34.3; 31.4-34.4) and of the associated cutouts (26.3; 26.4) are arranged at different distances from the cylinder axis in such a way that,

-- in the resting state of the lock cylinder, the control edges (41.3-44.4; 41.4-44.4) of more than two tumblers are at the same height (50.3; 50.4; 50.5), with the result that their positions are concealed.

21. Lock cylinder according to Claim 20, characterized in that the stop-counterstop pairs are arranged in such a way that,

-- the control edges (41.3-44.3; 41.4-44.4) are at the same height (60.3; 60.4; 60.5) after a lock-picking tool has pushed the tumblers (31.3-34.3; 31.4-34.4) down as far as possible against the spring-loading (13.3; 13.4), with the result that their positions are concealed.

22. Lock cylinder according to one or more of Claims 1-21, characterized in that, although all of the inserts (62.3; 62.3'; 62.4, 62.4') have essentially the same convex lobe profile (36.3, 36.3'; 36.4, 36.4') at their inner ends (64.3; 64.4), they are positioned in two different laterally reversed orientations in similar openings (61.3, 61.4) in the cylinder core;

-- where inserts with the normal orientation are considered normal inserts (62.3; 62.4), and inserts with the reverse orientation are considered mirror inserts (62.3'; 62.4'); and in that

-- the pairs of flanks (37.3i, 38.3i, 37.3a, 38.3a; 37.4, 38.4) of the normal lobes (36.3, 36.4) are essentially exact mirror images of those (38.3i, 37.3i, 38.3a, 37.3a; 47.4', 38.4') of the reversed lobes (36.3'; 36.4').

23. Lock cylinder according to Claim 22, characterized in that the normal lobe (36.3; 36.4) is laterally reversed with respect to a transverse plane (71.3; 71.4), which passes diametrically through the cylinder core (20.3; 20.4) in the area of the axis, transversely to the spring-loading (13.3; 13.4) of the tumblers (31.3-34.3; 31.4-34.4).

24. Lock cylinder according to Claim 1 and to Claim 22 or 23, characterized in that the maximum point of the lobe (36.3, 36.3'; 36.4, 36.4') positioned in the cylinder core (20.3; 20.4) lies essentially on the transverse plane (71.3; 71.4) of the cylinder core (20.3; 20.4).

25. Lock cylinder according to Claim 24, characterized in that the lobe profile (36.3; 36.3') has two pairs of flanks (37.3a-38.3i), namely, an inner pair (37.3i, 38.3i), which is

closer to the transverse plane (71.3) of the cylinder core (20.3), and an outer pair (37.3a, 38.3a), which is farther away from the transverse plane (71.3).

26. Lock cylinder according to Claim 25, characterized in that the flanks of inner flank pair (37.3i, 38.3i) are symmetrical to the transverse plane (71.3) of the cylinder core (20.3),

-- whereas the flanks (37.3a, 38.3a) of the outer flank pair are asymmetric with respect to the transverse plane (71.3).

27. Lock cylinder according to one or more of Claims 24-26, characterized in that the flanks of the inner flank pair (37.3i, 38.3i) are parallel to the transverse plane (71.3), whereas

-- the flanks of the outer flank pair (37.3a, 38.3a) are positioned at an angle to the transverse plane (71.3).

28. Lock cylinder according to Claim 27, characterized in that the two outer flanks (37.3a, 38.3a) have slanted orientations which are essentially mirror images of each other.

29. Lock cylinder according to Claim 28, characterized in that the length of one of the outer flanks (37.3a) is different from that of the other outer flank (38.3a).

30. Lock cylinder according to Claim or 22 or Claim 23, characterized in that the maximum point of the lobe (36.4, 36.4') is located a certain distance away in the height direction from the transverse plane (71.4) of the cylinder core (20.4).

31. Lock cylinder according to Claim 30, characterized in that the lobe (36.4, 36.4') is positioned at the high end (73, 73') of the insert (62.4, 62.4').

32. Lock cylinder according to Claim 30 or Claim 31, characterized in that the convex lobe profile (36.4) of the normal insert (62.4) is an exact mirror image -- in the direction of the longitudinal movement of the tumblers (41.4-44.4) -- of the lobe profile (36.4') of the mirror insert (62.4').

33. Lock cylinder according to one or more of Claims 30-32, characterized in that, although the lobe (36.4, 36.4') has only one pair of flanks (37.4, 38.4; 37.4', 38.4'), one of the flanks (37.4, 37.4') has a form different from that of the other flank (38.4, 38.4').

34. Lock cylinder according to Claim 33, characterized in that one of the flanks (38.4, 38.4') is essentially parallel to the transverse plane (71.4) of the cylinder core (20.4), whereas

the other flank (47.4, 47.4') forms an angle to that plane.

35. Lock cylinder according to one or more of Claims 22-34, characterized in that the normal inserts (62.4) and the mirror inserts (62.4') are arranged in an alternating sequence in the successive shafts of the cylinder core (20.4).

36. Lock cylinder according to Claim 12 and Claim 35, characterized in that the normal inserts (62.4) and the mirror inserts (62.4') constitute the teeth of a comb (68), which has an even number of teeth; and in that

-- the comb (68) can be inserted into the cylinder core (20.4) in either a normal or a reversed orientation,

-- where the comb (68) begins with a normal insert (62.4) when inserted in one of the two orientations, whereas a mirror insert (62.4') is at the front of the comb (68) when the comb is inserted with the other orientation.

37. Lock cylinder according to Claim 1 and Claim 22 or Claim 23, characterized in that, although the cutouts (26.3; 26.4) in the individual tumblers (31.3-34.3; 31.4-34.4) are of similar shape, they have different dimensions as a function of the height position (45-48) of the control edge (41.3-44.3; 41.4-44.4).

38. Lock cylinder according to Claim 37 and to Claim 20 or Claim 21, characterized in that the cutouts (26.3) are designed with two steps and thus produce two pairs of opposing flanks (27.3a-28.3i) at different depths,

-- namely, an inner pair of opposing flanks (27.3i, 28.3i) on the lower step of the cutout (26.3) and an outer pair (27.3a, 28.3a) on the upper step.

39. Lock cylinder according to Claim 37, characterized in that the cutout (26.4) has a separating web (74.1-74.4), and in that

-- as a function of the height position of the control edge (41.4-44.4) of the associated tumbler (31.4-44.4), the lengths or positions (76.1-76.4) of the cutouts (26.4) and/or the positions of the webs (74.1-74.4) in the cutouts and/or the lengths of the webs are different.

40. Lock cylinder according to Claim 39, characterized in that the separating web (74.1-74.4) is positioned essentially at the longitudinal midpoint (75.1-75.4) of the cutout (26.4).

41. Lock cylinder according to Claim 39 or Claim 40, characterized in that the cutouts (26.4) have two pairs of opposing flanks (27.4a-28.4i),

-- where one of the pairs of opposing flanks (27.4i, 28.4i) is formed by the two terminal edges of the separating web (74.1-74.4), which form inner opposing flanks (27.4i, 28.4i), which face away from each other;

-- whereas the other pair of opposing flanks (27.4a, 28.4a) is formed by the two inner edges at the outer end of the cutout (26.4), which form outer opposing flanks (27.4a, 28.4a), which face each other.

42. Lock cylinder according to Claim 38 or Claim 41, characterized in that the inner opposing flanks (27.4i, 28.4i) have a design different from that of the outer opposing flanks (27.4a, 28.4a).

43. Lock cylinder according to Claim 42, characterized in that the inner opposing flanks (27.4i, 28.4i) are essentially parallel to the transverse plane (71.4) of the cylinder core (20.4), whereas the other opposing flanks (27.4a, 28.4a) are at a certain angle to the transverse plane (71.4).

44. Lock cylinder according to Claim 43, characterized in that the angles of the two outer opposing flanks (27.4a, 28.4a) are essentially mirror images of each other.